THE
EUGENICS REVIEW

Editorial Offices: The Eugenics Society, 69 Eccleston Square, London, S.W.1. (*Telephone—Victoria 2091.*)

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"*Eugenics is the science which deals with all influences that improve the inborn qualities of a race; also with those that develop them to the utmost advantage.*"—*Sir Francis Galton, 1904.*

NOTES OF THE QUARTER

DR. E. B. FORD'S opening paper at the Royal Society of Medicine's discussion on "Birth Control: Some Medical and Legal Aspects" would not perhaps be everybody's idea of light reading, but because in a small compass it sets out a geneticist's view of what reasonably may, and what should not, be expected from the application of birth control to hereditarily afflicted persons, using the term birth control to denote any expedient for the limitation or complete prevention of fertility, and because it classifies familial disorders in relation to the efficacy of eugenic measures for their elimination, it well repays the painstaking study that would be required from most of us for its comprehension.

In summarizing a paper which is itself a summary, for no one could accuse Dr. Ford of being prolix or discursive, much must necessarily be omitted, but the main argument stands out clearly enough and is in fact epitomized by the author in the statement that "whether or not patients, or their near relations, suffering from familial disorders can properly be advised to resort to birth control [in this context, sterilization] depends on the way in which the disease is inherited." In other words, most general statements about eugenic sterilization, that it is effective or useless, a good or a bad thing, are of little value. The matter should always be discussed in specific terms; not the utility or otherwise of eugenic sterilization in hereditary disease, but eugenic sterilization in a *defined* condition and in a person of *defined* hereditary constitution.

The whole matter can be put into perspective by two or three simple examples. Suppose that the problem is whether sterilization should be recommended in a case of simple heterozygous defect. Such a condition can only be transmitted by the person actually affected (even though, as for instance in Huntington's chorea, the disease may not become manifest till fairly late in life when the patient has already produced a family), but the chances are that it will be transmitted to half the patient's children. Here the issue is usually straightforward. There are no normal "carriers" to consider; the problem is quite simply whether or not the patients themselves, those who manifest or may later on manifest the disease, should be sterilized, and if the disease is serious there can be little doubt as to what the answer should be.

The problem is almost as simple when we are dealing with recessive familial defects controlled by single genes. The affected persons in such cases usually have normal parents, and their children are phenotypically normal too. But not genetically normal, for all of them will be heterozygotes, liable to transmit the manifest condition. The chances of such an event, however, are very small, for the disease will reappear only from the union of two such heterozygotes, and then on the average in only a quarter of

the offspring. The relative distribution in the population of the three groups—truly normal persons (that is, normal with respect to a given recessive defect), apparently normal carriers (the heterozygotes), and those actually affected (the recessives)—is, in fact, such that if only one person in 10,000 belonged to the third group there would also be over two in every 100 liable to transmit the corresponding defect. In other words, the genes, even of rare defects, are so widely scattered that there could be no hope of eliminating them by any existing eugenic measures. Moreover, it must be borne in mind, as Dr. Ford points out, that rare heterozygous as well as recessive defects are maintained in equilibrium by a balance of two forces—namely selection which tends to eliminate them and mutation which tends to increase their frequency. Even if all the actual sufferers from a given single-gene recessive defect were sterilized or otherwise prevented from having children, the defect, being transmitted almost entirely by the apparently normal heterozygotes, would reappear with practically unaltered frequency, even in the generation immediately following. Simple heterozygous conditions, on the other hand, could be virtually eliminated by such measures, but they would nevertheless reappear in later generations as a result of mutation.

Putting aside for a moment the wider eugenic objectives, however, namely elimination of hereditary disease from the whole population, and considering the problem only as it concerns persons in whose family a recessive defect is inherited, it can be said that for them it is more dangerous than for other people to marry near relatives, because of the far greater risk they run of bringing two harmful recessives together. For example, in the hypothetical instance just described, when two in every 100 of the population are heterozygotes, the chances, in a random mating, that a given heterozygote will marry a person who is heterozygous for the same defect are 49 to 1 against; but the risk is multiplied by seven if the marriage is with a first cousin. Here again the physician called upon to give premarital advice is faced with a fairly defined problem, to which it is possible to envisage diverse, but equally definite, solutions.

As an illustration of his argument, Dr. Ford considers what advice should be given to persons suffering from, or possibly carrying, two well-known sex-linked recessive diseases—retinitis pigmentosa and hæmophilia. With respect to the former the facts, briefly, are that

> no man can transmit the disease unless he himself be a sufferer, and he will do so to all his daughters and none of his sons. Affected women are very rare, since they must be homozygous. Heterozygous women, the "carriers" who receive the gene in single dose, transmit it to half their children, the sons develop the disease while the daughters are again "carriers." Thus the sisters of an affected patient can be told that for them there are two alternatives. That is to say, should they marry, either half their sons will be affected and half their daughters will be carriers, or else none of their children will suffer from the disease nor can any transmit it. For such a woman, the probability of these two situations is exactly equal, and she may well feel that she should not beget children. The chance is of course one in four that any women with an affected uncle (but not affected brother) is a carrier.
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> Until recently, the same unsatisfactory dilemma faced women closely related to sufferers from hæmophilia, the most famous of the sex-linked recessives. However, Andreassen, working in Denmark, has shown that, by appropriate measurements of coagulation time, heterozygous women can be distinguished from true normals. This is a considerable advance. The sisters of hæmophiliacs can now be told definitely that they should not have children or, alternatively, that they can do so with safety.

The single-gene defects so far considered are extremely rare, though that does not mean that they do not present serious problems, in social as well as individual medicine. When we come to mental defect, however, we are concerned with a condition which, in its hereditary forms, has usually a multifactorial basis. Apart from its high frequency it differs, as Dr. Ford reminds us, in two ways from single-gene defects, whether heterozygous or recessive.

> First, there is a tendency for mental defectives to beget more, not fewer, children than normal,

and secondly, multifactorial disorders are much more susceptible to the effects of selection than are unifactorial ones.

Consequently, if it were possible to prevent all mental defectives from having children, the frequency of the condition could be materially and quickly reduced. The desirability of birth control measures, and the difficulty of their application, in individual instances of mental deficiency, are sufficiently obvious to need no elaboration.

Perhaps the most interesting point in this argument is that mental defectiveness is susceptible to eugenic control precisely because it *is* multifactorial. It is interesting because much criticism of negative eugenics has turned on the contrary assumption: that sterilization and other negative eugenic measures must prove ineffective in cases of mental defectiveness, because, with very rare exceptions, this condition is due not to a single gene but to the interaction of many genes. Dr. Ford's paper is valuable not merely as a corrective of this genetical error, but as a reasoned and orderly statement of the limitations as well as of the potential achievements of negative eugenics in the control of hereditary disorders.

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The *Eugenics Society* has made itself responsible for the publication of a series of pamphlets under the general title of *Occasional Papers on Eugenics*.

This is a new venture whose development will naturally be watched with care; but any doubts as to its value as a means of informing the public about the basis of eugenics and the objectives of eugenic policies must be dispelled by the reception given to the second pamphlet in the series, Sir Cyril Burt's *Intelligence and Fertility*.* Within a few days of publication this authoritative survey had formed the subject of leading articles in *The Times*, *The Manchester Guardian* and *The Times Educational Supplement*, and had been extensively noticed in the news and review columns of the national and provincial Press. It is clear that the public is ready, as perhaps never before, to pay serious attention to problems concerned with the biological qualities of our population, and that given suitable material the Press can be trusted to play its part in presenting the issues in a balanced and informative manner.

Originally prepared at the request of the Royal Commission on Population, Sir Cyril's study is concerned with the problem whether the different birth rates that prevail in different families and social groups are likely to alter the inherited mental qualities of the nation; and more particularly whether there is a risk that they may result in a decline in the general level of inborn intelligence. That the Commission should have asked for information on this vital matter may be taken as a fair and most encouraging indication of the view it is taking of its responsibilities. We now know that problems of numbers and age distribution, pressing and important as they are, are not occupying the attention of the Commission to the exclusion of problems of human quality; and we may reasonably assume that its final recommendations will be directed to an improvement in the qualitative as well as the numerical trend in our population. The Commission is fortunate in having before it so clear a statement of the nature and magnitude of not the least important aspect of the problems for which an enlightened population policy must offer a solution.

Sir Cyril's conclusions, based largely on his own investigations when serving as psychologist to the London County Council, may be given in his own words:

> So far as the evidence goes (*a*) it seems almost certain that there is in this country a negative correlation between innate intelligence and size of family, and that the size of the correlation (about $-0{\cdot}20$) is large enough to demand urgent practical attention; (*b*) it seems highly probable that the average level of intelligence among the general population may be declining at a rate which might produce serious cumulative effects if at all sustained; (*c*) finally, it seems more

* Published by the *Eugenics Society* and Hamish Hamilton Medical Books, price 2s. net. A special edition, for which application should be made to the Business Secretary, is available to Fellows and Members of the *Society* for 1s. 6d. Copies of the first pamphlet in the series, Dr. Blacker's *Eugenics in Retrospect and Prospect*, can also be obtained (price 1s. 6d.) from the *Society* or from the publishers.

> probable than not that, with characteristics other than intelligence (e.g. temperamental or moral qualities such as relative freedom from neurotic or delinquent tendencies and physical characteristics such as health and strength), the effects of the differential birth rate are smaller, but, if anything, unfavourable rather than favourable.

Whatever may have been true in the past, the problem, as he sees it, is now not so much one of differential class fertility as of differential fertility between the more and the less intelligent families of the same class. As he points out, surveys in different types of schools, including some in which all the pupils were recruited from fairly homogeneous social and occupational groups, reveal a close correlation between intelligence and small family size, and he adds :

> At present, no doubt, social class, which so largely determines the aims of the parent for his child, may be a factor almost as important as intelligence—except perhaps in the highest intellectual group of all : it is when the bright child from the poorer classes has won his way to a higher social stratum, and has himself turned into a parent, that the desire to limit family-size becomes so marked ; he himself perhaps was one of five or six children, but he produces only two or three. Nevertheless, with the rise in the standard of living and pleasure throughout the whole community, the class correlation will, I feel sure, grow smaller : and the partial correlation with intelligence will soon out-weigh the partial correlation with occupational category or economic group. It has been perhaps a little unfortunate that the correlation with class, being the easiest to determine, came too early into the picture, and thus side-tracked the argument. Social origin and economic level, as such, may soon prove wholly irrelevant to the argument.

It is characteristic of the scientific caution with which Sir Cyril approached his task that he offers, as the only conclusions which other psychologists will accept as beyond all reasonable doubt, that there is an overwhelming case for a large and systematic inquiry into our national intelligence (for " as a nation we should know our resources in mind-power as accurately as we do in man-power, iron or coal "), and that " the inquiries already carried out show that the psychological and statistical techniques are now sufficiently developed to make a full-scale inquiry well worth while, provided it is planned and carried out by investigators adequately trained."

For the details, which include full accounts of the investigations from which the conclusions have been derived and a critical analysis of the meaning of intelligence and the significance of intelligence tests, the reader is referred to the pamphlet itself. It is so much more readable than any summary could be that we have no compunction in making this recommendation. Incidentally, *The Economist* particularly recommends the pamphlet to the Chancellor of the Exchequer, who, it says, might well ponder its contents before he frames his coming budget !

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In his letter on " Eugenic Implications of the Rhesus Factor," Mr. Herbert Brewer raises genetical problems of great complexity.

Starting from the fact, which he states quite correctly, that about 10 per cent. of the babies born to-day are in danger of developing erythroblastosis fœtalis (the condition becoming manifest in about 1 in 250), he argues that

> just as fertilization with selected sperms may conquer sterility in many otherwise hopeless cases, so the same technique provides the only rational remedy in matings where incompatible Rh factors make the attempt to create a family merely a succession of heart-breaking tragedies for all concerned. The Rh negative woman, who, as long as she receives Rh positive sperms from her otherwise worthy husband, is delivered of dead fœtuses or degenerate living offspring as the melancholy consequence, may bear healthy children if fertilized by selected sperm not carrying the Rh antigen.

We have in this proposal a specific application of " eutelegenesis "—a term originally coined by Mr. Brewer for the use of artificial insemination to serve eugenic ends—and it is worth considering whether its adoption would in fact yield the desired result. This does not mean that the proposal may not also be regarded from other points of view at least equally important—far from it ; but for the purpose of this discussion the perplexing moral, psychological and social

problems involved in eutelegenesis may be put aside and the matter examined in strictly genetical terms.

What would happen if events were allowed to take their course? If for the moment we consider all the allelomorphs which give a Rhesus positive result as forming a single group, it is clear that we have at present a population that is far from equilibrium. Professor Haldane has pointed out that selection against the Rh negative allelomorph will automatically lead to its reduction, and on certain assumptions that need not be gone into here as to the intensity of this selection has calculated that it would take 619 generations—say 15,000 years—to reduce the Rh negative population from 13·9 per cent (the present level in America) to 1 per cent. But there are a number of circumstances which may upset this calculation, in particular the possibility that the process of selection may be counterbalanced by a selective advantage of heterozygotes or even of Rh negative homozygotes. In fact it is impossible to say, except in a statement completely hedged in with qualifications, what would happen if in this matter the population were left to itself.

If, however, Mr. Brewer's measures were put into effect the population would tend to separate into two genetic groups, namely some 60 per cent homozygous positive and some 40 per cent homozygous negative. And as long as these measures remained fully effective, that is to say as long as there were no uncontrolled matings (not a very likely assumption), there would of course be no children born with erythroblastosis fœtalis.

What would happen to such a population if mating ceased to be so rigidly controlled? Some 24 per cent of marriages and all the children born of them (with the possible exception of first-born children) would then be susceptible, instead of only about 10 per cent as at present. Mr. Brewer would hardly regard this as a desirable result, and indeed in a personal communication he showed, with characteristic ingenuity and foresightedness, that he was not unaware of the danger.

It need hardly be added that this statement of the problem is much over-simplified. To mention only two complicating factors, it does not take account of the fact that there are several different Rh positive allelomorphs, nor does it consider whether the splitting of the population into two genetically distinct groups would proceed to its final conclusion or reach equilibrium at an earlier stage. But even this admittedly incomplete statement does suggest that eutelegenesis, though it might conceivably solve the problem of the individual couple with Rh incompatibility, would in the long run, if widely adopted, exacerbate rather than reduce the chances of Rh incompatible matings.

We have to conclude, then, that at the moment the problem admits of no genetical solution; though this should not be taken to imply that the outlook is quite hopeless. Some Rh negative women may decide, voluntarily, to marry within their own Rh group; but for the rest an immunilogical solution of the problem is at least feasible. Haldane has in fact suggested that "if the Rh haptene could be isolated from its protein carrier, it might be possible to inject it into pregnant women in such amounts as to neutralize their anti-Rhesus agglutinin and thus prevent erythroblastosis fœtalis."

Would not Mr. Brewer regard this as a desirable alternative to eutelegenesis?